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(54) **SYSTEM AND METHOD FOR ESTIMATING PERFORMANCE OF A CLOSED CYCLE THERMAL PROPULSION SYSTEM**

(75) Inventor: **William A. Girouard**, South Dartmouth, MA (US)

(73) Assignee: **The United States of America as represented by the Secretary of the Navy**, Washington, DC (US)

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(58) **Field of Search** 60/646, 657

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,117,635 A	*	6/1992	Blau	60/668
5,131,231 A	*	7/1992	Trimble et al.	60/649
5,233,823 A	*	8/1993	Day	60/775

* cited by examiner

Primary Examiner—Hoang Nguyen

(74) *Attorney, Agent, or Firm*—James M. Kasischke; Michael F. Oglo; Jean-Paul A. Nasser

(57) **ABSTRACT**

The present invention permits determination of steady-state off-design performance characteristics of a vehicle, such as a torpedo, powered by a closed cycle thermal propulsion system. The method may be utilized to determine propellant consumption for a torpedo resulting from various off-design kinematic maneuvers. Total run time may be calculated in response to a plurality of torpedo speed changes and/or torpedo configurations of variable torpedo length or torpedo diameter. The present invention may be utilized to define weapon design options for existing or future underwater weapons with mission requirements different from those for which the weapons were originally designed.

6 Claims, 4 Drawing Sheets